Rule CIC165: The "look-aside" read hit ratio was low for VSAM LSR pool

Finding: CPExpert has detected that the "look-aside" read hit ratio was low for a VSAM Local Shared Resources (LSR) pool.

Impact: This finding should normally have a MEDIUM IMPACT or HIGH IMPACT on the performance of the CICS region.

Logic flow: This is a basic finding, based upon an analysis of the daily CICS statistics.

Discussion: VSAM files assigned to a LSR pool share common buffers (and also share strings) assigned to the LSR pool. Since the buffers are shared, significantly fewer buffers normally are required to support I/O access operations. This is because not all files will be accessed at any particular time. Rather, file accesses will tend to be distributed across files at different times. Some files will have requirements for buffers at one time, while at another time they will not be accessed and will not require buffers. The demand for buffers therefore is the **peak collective demand** rather than the **sum** of the **peak individual** demands.

For example, 3 files might individually have a peak I/O access demand for 5 buffers. The sum of the individual buffers required to prevent buffer waits would be a total of 15 buffers (3 * 5). However, the peak collective demand would normally be less than 15 buffers. If there were no overlap of I/O access operations among the files, the peak collective demand would be only 5 buffers.

In practice, the peak collective demand for buffers is usually less than half of the sum of the peak individual demands. Assigning files to LSR pools therefore significantly decreases the storage requirements to support CICS VSAM buffers.

With CICS Version 1.7, the LSR buffers moved above the 16 megabyte line. Consequently, the storage savings generally are not as important as they were with previous versions of CICS.

However, there is an extremely important advantage to using LSR pools for VSAM files: VSAM will use its "look-aside" logic to determine whether a required control interval (CI) is already in a buffer, before executing any physical I/O operations. If the required record is already in a buffer, VSAM will use the record in storage, rather than issuing a read to DASD. This has the effect of implementing an in-storage caching of the file, and can **significantly** reduce the number of physical I/O operations required.

With sufficient buffer allocation, VSAM often can find 80%-95% of the I/O requests for index records in buffers, and over 50% of the I/O requests for data records in buffers. Whether records are in a buffer is, of course, a function of the file size, the file accessing characteristics, etc. However, allocating sufficient buffers to LSR pools (and assigning VSAM files to the LSR pools) often can produce a **significant** performance improvement for CICS.

The CICS statistics provide information about the number of times an I/O request was satisfied because VSAM found the data in a LSR buffer. This value is titled "LOOK-ASIDE HITS" in the statistics. The CICS statistics also provide information about the number of times an I/O request was NOT satisfied by data in a LSR buffer. This value is titled "BUFFER READS" in the statistics. These two values are provided for each LSR pool and LSR subpool (a LSR subpool refers to the buffers of a particular size in the LSR pool).

CPExpert analyzes statistics relating to the files assigned to LSR pools to determine the subpool sizes used for data and index buffers. The LSR pool "look-aside hits" statistics are then evaluated based upon whether the subpools are used for data or index records.

CPExpert calculates the percent of "look-aside hits" versus total I/O access operations (the sum of "look-aside hits" and "buffer reads"). The resulting percent is compared with one of two guidance variables, depending upon how the subpool is used. If the subpool is used for data records, the percent is compared to the LSRHITD guidance variable. If the subpool is used for index records, the percent is compared to the LSRHITI guidance variable. The default values for the LSRHITD and LSRHITI guidance variables are 40% and 80%, respectively.

If the subpool is used for both data and index records, CPExpert tests the index LSRHITI guidance variable first. This is done since index records should have a higher hit ratio than data records.

CPExpert produces Rule CIC165 if the percent of "look-aside hits" is lower than the appropriate guidance variable.

Suggestion: As mentioned above, allocating sufficient buffers to LSR pools (and assigning VSAM files to the LSR pools) often can produce a **significant** performance improvement for CICS. Under many circumstances, Rule CIC165 should mean that additional buffers should be allocated to the LSR subpool.

The normal technique is to add buffers to the LSR subpool until the "look-aside hit" read ratio is at an acceptable level. This approach must be

guided by the availability of virtual storage. Further, there usually is no point in adding buffers once the "look-aside hit" read ratio ceases increasing.

There are a number of unique situations, however, in which allocating more buffers to the LSR subpool may not be an appropriate action.

- The files are very large and their processing characteristics imply that there is little probability that a required record will be in a LSR buffer.
- A large active file is processed in a manner such that it dominates the buffer subpool. In this case, you may wish to place the file into a LSR pool of its own.
- Storage is a constraint to CICS performance (or to overall system performance). Increasing the number of LSR buffer pools may be unacceptable in this situation.
- Data records and index records have the same CI size for some files assigned to the LSR subpool. In this situation, the data records often will dominate the subpool and there will be a low "look-aside hit" ratio for the subpool.

Reference: *CICS/OS/VS Version 1.7 Performance* Guide: pages 65-68, pages 232-238, and page 244.

CICS/MVS Version 2.1.2 Performance Guide: pages 158-162, page 170, and pages 394-397.

CICS/ESA Version 3.1.1 Performance Guide: pages 71-73, pages 93-106, and page 239.

CICS/ESA Version 3.2.1 Performance Guide: pages 147-152, page 155, and pages 310-321.

CICS/ESA Version 3.3.1 Performance Guide: pages 157-162, pages 165-166, and pages 329-339.

CICS/ESA Version 4.1.1 Performance Guide: Section 4.4.2, Section 4.4.4, and Appendix A.1.11.

CICS/TS Release 1.1 Performance Guide: Section 4.4.2, Section 4.4.4, and Appendix 1.1.9.

CICS/TS Release 1.2 Performance Guide: Section 4.4.2, Section 4.4.4, and Appendix 1.1.10.

CICS/TS Release 1.3 Performance Guide: Section 4.6.2, Section 4.6.4, and Appendix 1.1.11.

CICS/TS for z/OS Release 2.1 *Performance Guide*: Chapter 18 (VSAM resource usage (LSRPOOL)), Chapter 18 (VSAM buffer allocations for LSR), and Appendix A (Table 53).

CICS/TS for z/OS Release 2.2 *Performance Guide*: Section 4.5.2 Defining VSAM resource usage, Section 4.5.4 Defining VSAM buffer allocations for LSR, and Appendix 1.1.17.6.

